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Shida et al.

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(54) **CUTTING DEVICE AND IMAGE FORMING SYSTEM**

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(51) **Int. Cl.**

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B26D 5/14	(2006.01)
B26D 7/01	(2006.01)
B26D 7/00	(2006.01)

(52) **U.S. Cl.**

CPC .. ***B26D 5/02*** (2013.01); ***B26D 1/08*** (2013.01); ***B26D 5/14*** (2013.01); ***B26D 7/015*** (2013.01); *B26D 2007/005* (2013.01); *B26D 2007/0056* (2013.01); *B26D 2007/0081* (2013.01); *Y10T 83/8749* (2015.04)

(58) **Field of Classification Search**

CPC B26D 1/08; B26D 5/14; B26D 7/015; B26D 5/02; B26D 2007/0056; B26D 2007/0081; B26D 2007/005

USPC 400/621; 412/16; 399/407, 408, 410; 83/934, 564, 601, 627, 642, 646, 83/356.2; 101/226

See application file for complete search history.

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(57) **ABSTRACT**

A cutting device includes a main body unit and a support unit. The main body unit includes a cutting unit on a lower side. The cutting unit cuts off an edge portion of paper. The support unit supports the main body unit in such a way that the main body unit rotates. The main body unit exposes a blade of the cutting unit at least on a lateral side by rotating.

6 Claims, 10 Drawing Sheets

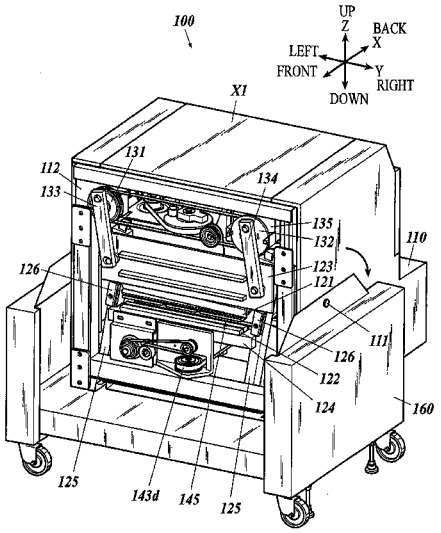


FIG.1

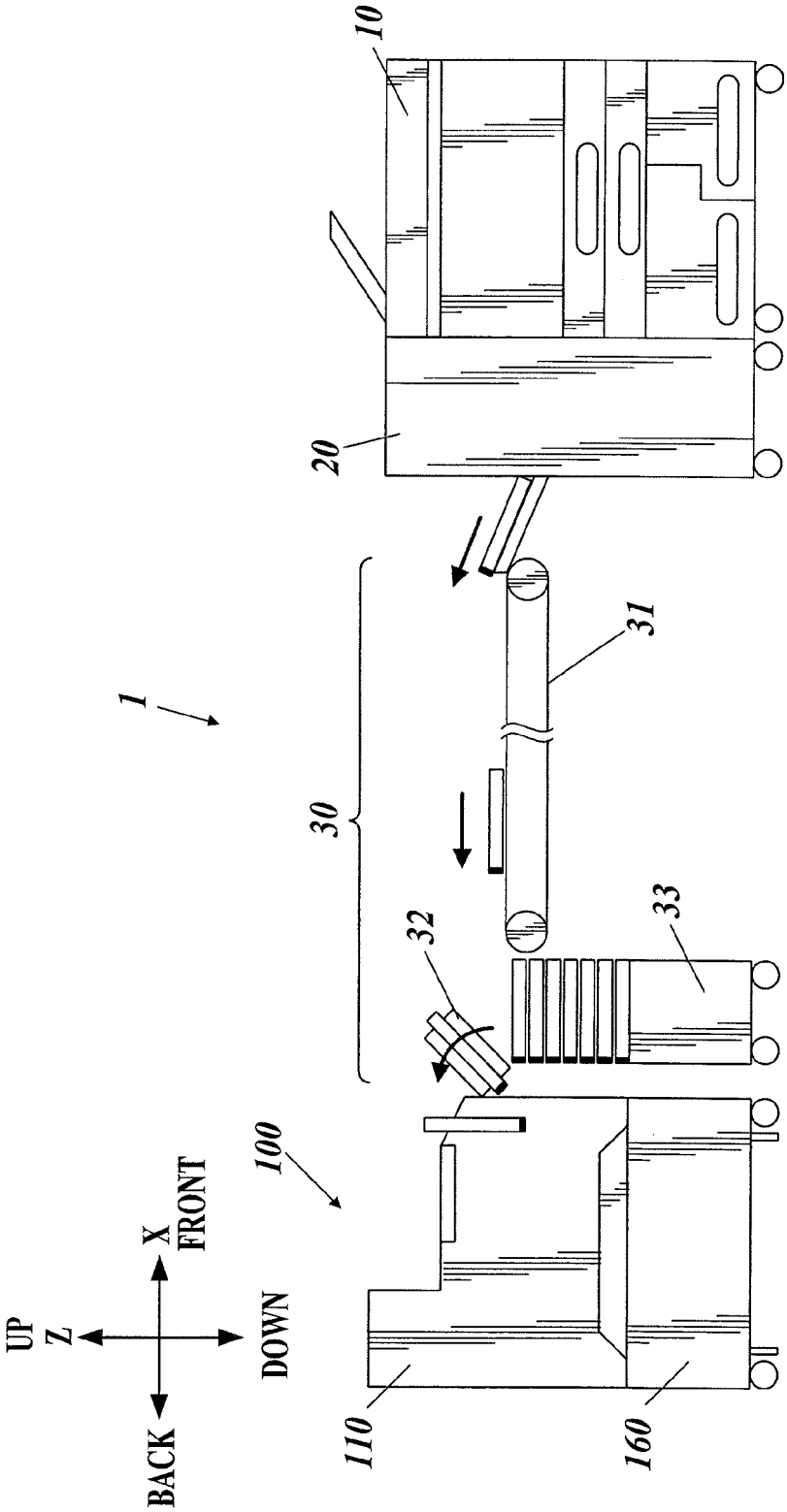
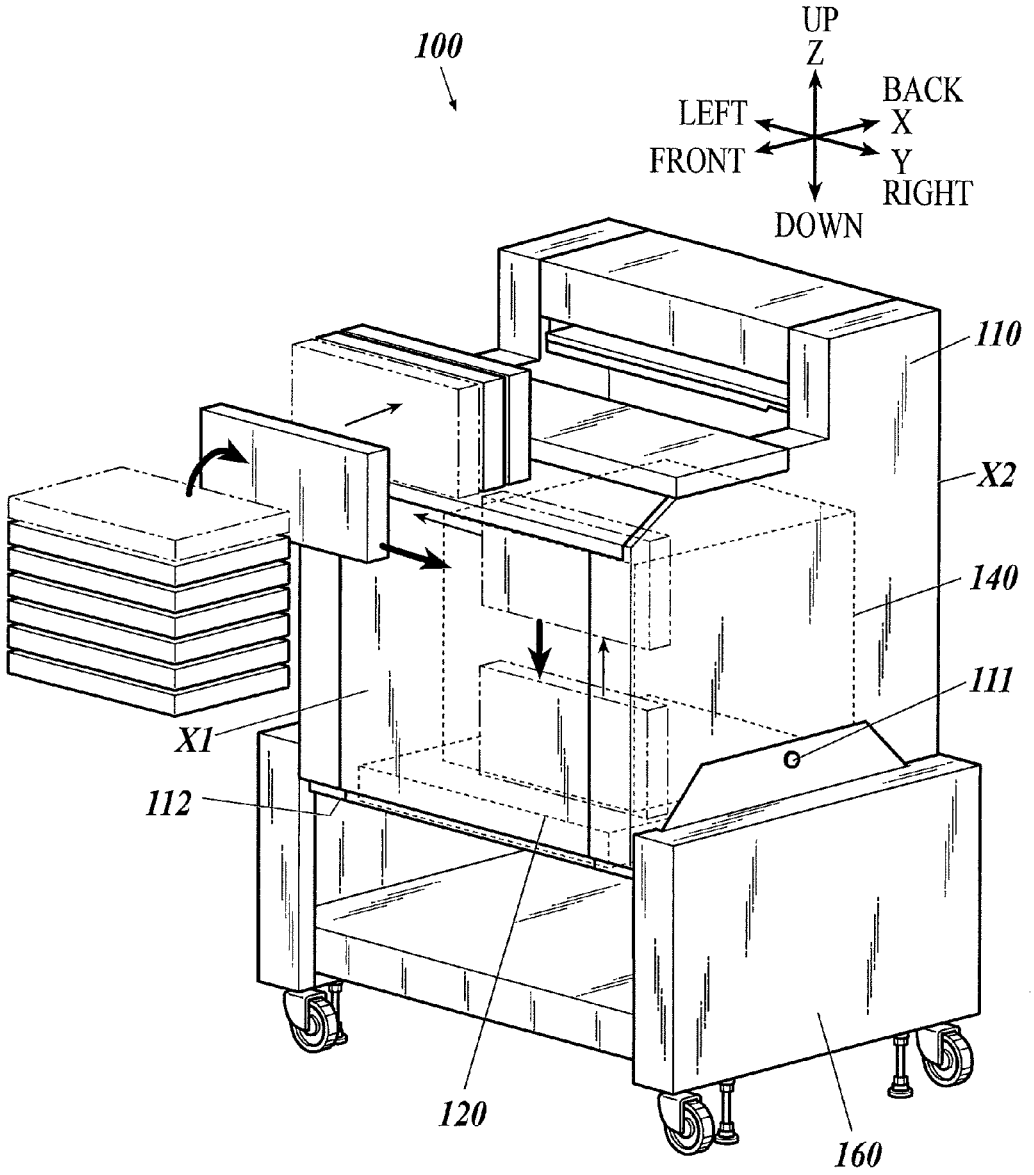


FIG.2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UP
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FRONT
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RIGHT
DOWN
110
X2
140
111
X1
112
120
160

FIG.3

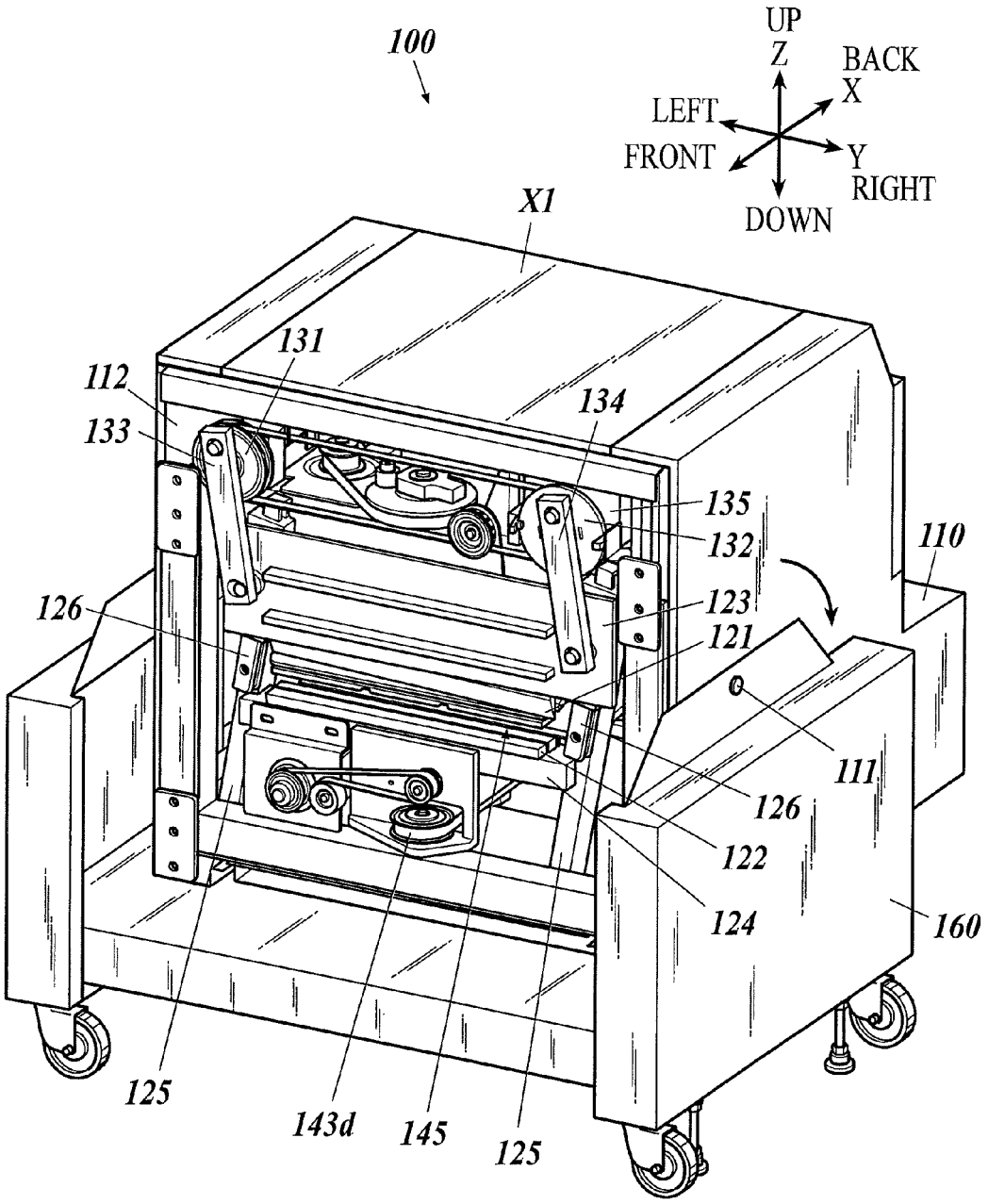

100
UP
Z
BACK
X
LEFT
FRONT
Y
RIGHT
DOWN
X1
131
112
133
134
135
132
110
126
123
121
111
126
122
124
160
125
143d
145
125

FIG.4

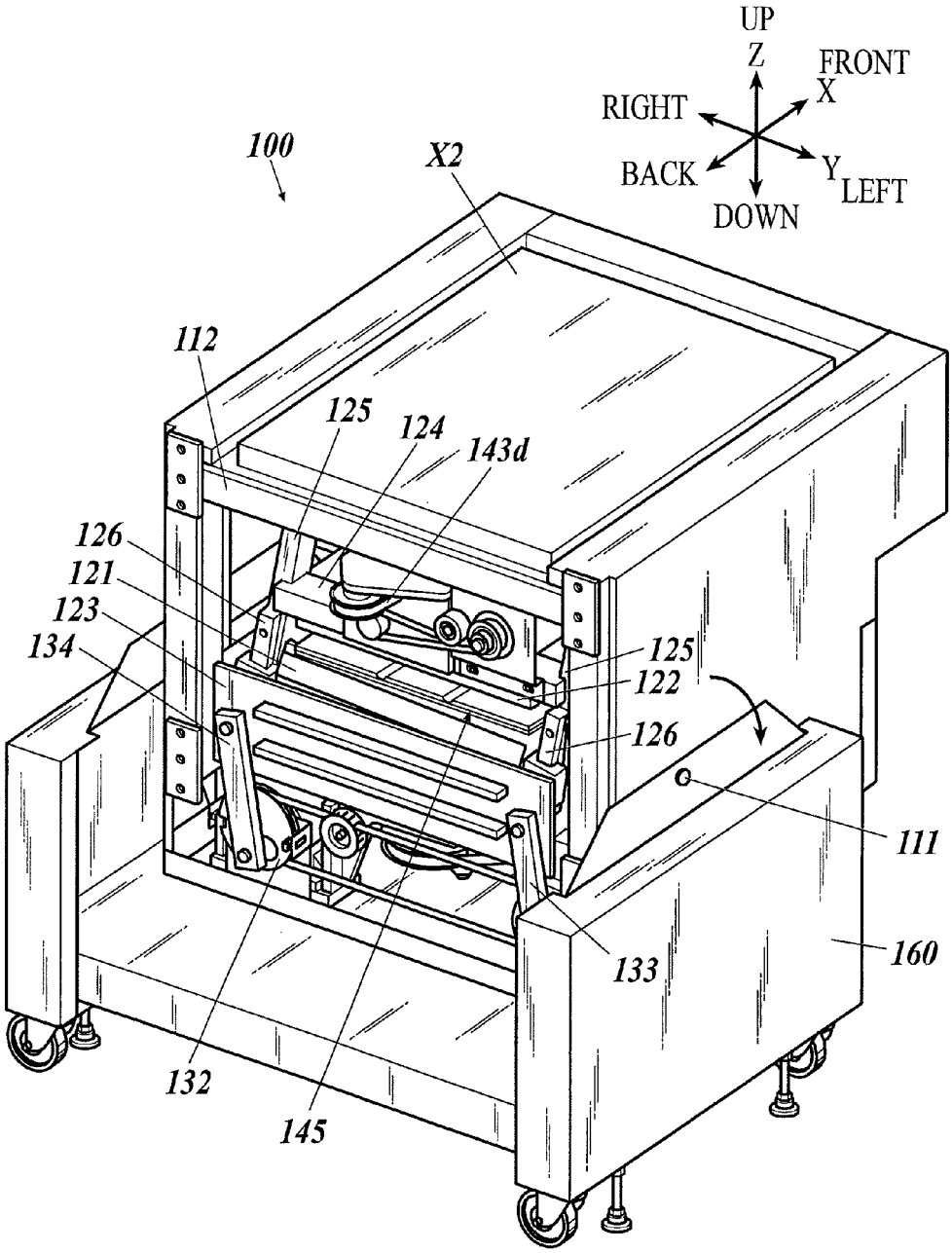

UP
Z
FRONT
X
RIGHT
BACK
Y
LEFT
DOWN
100
X2
112
125
124
143d
126
121
123
134
125
122
126
111
160
133
132
145

FIG.5

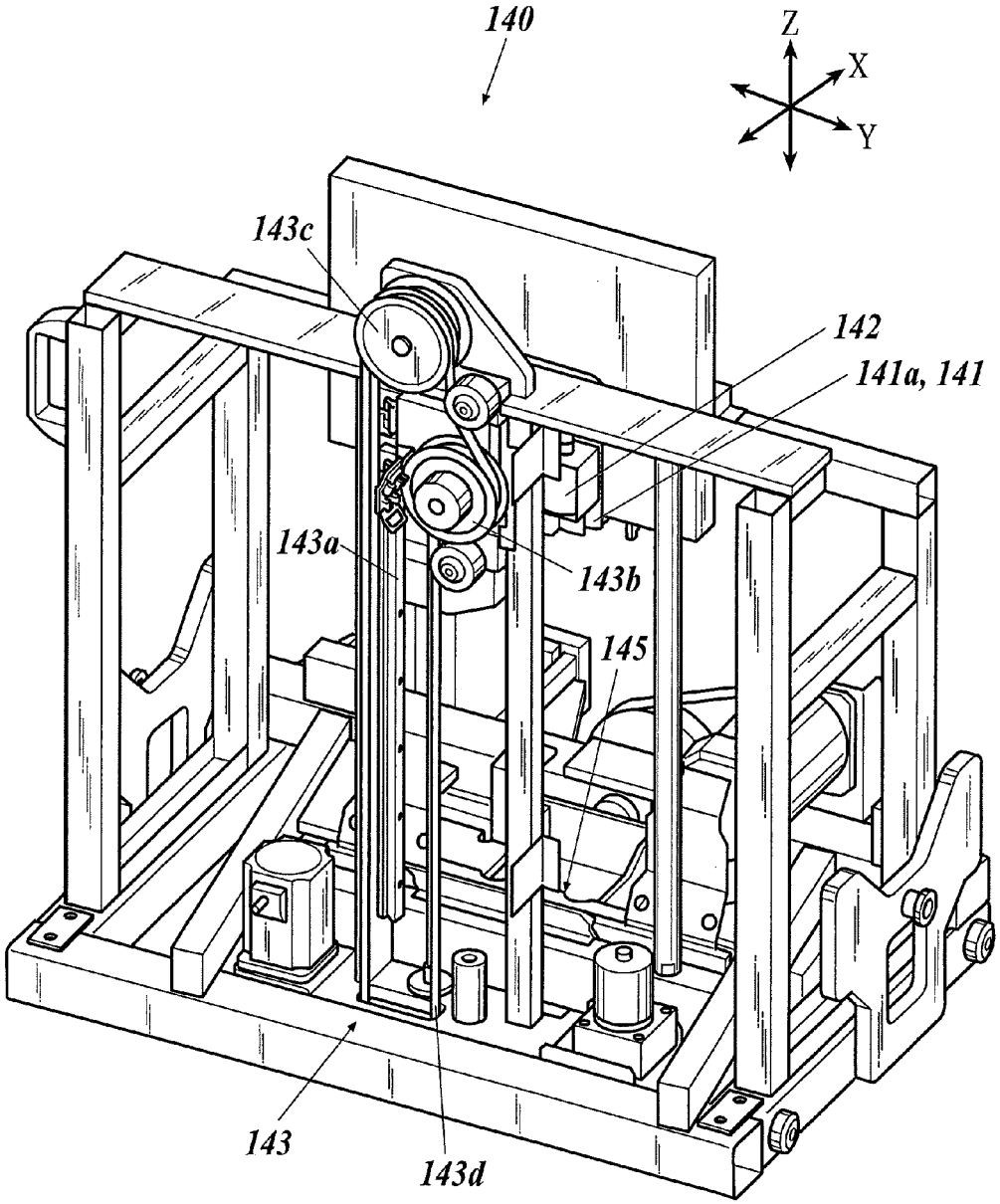


FIG.6

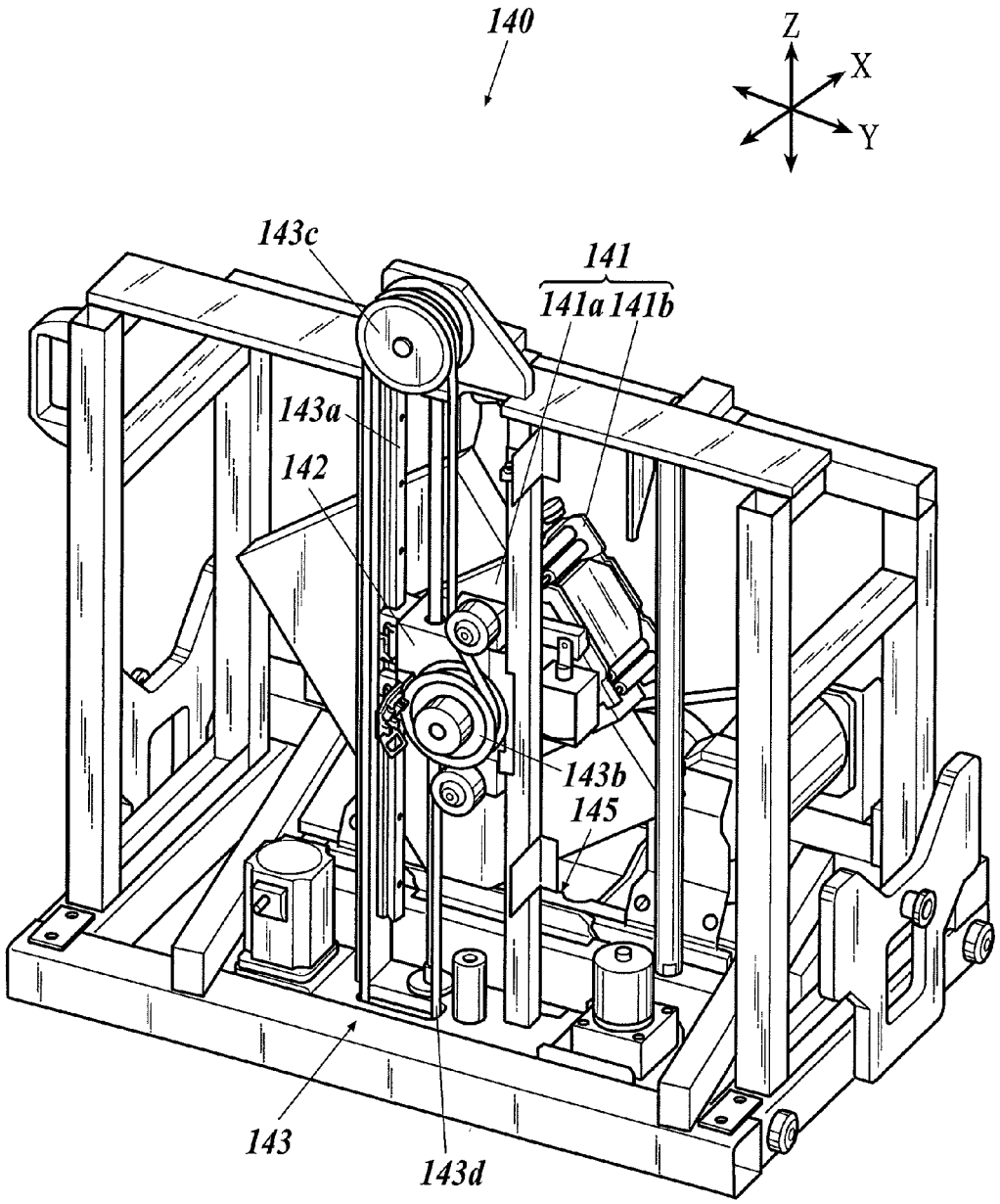


FIG. 7

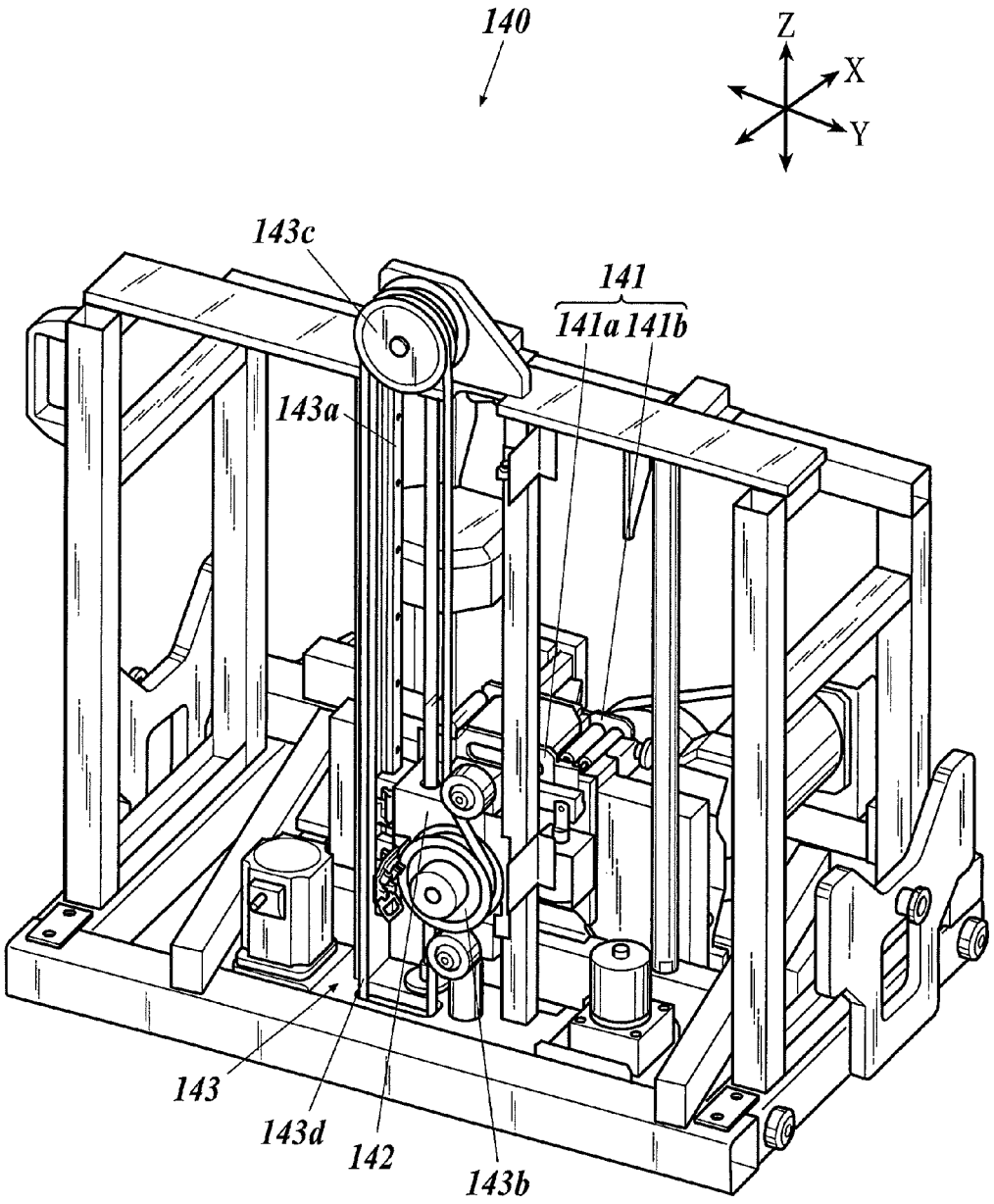


FIG.8

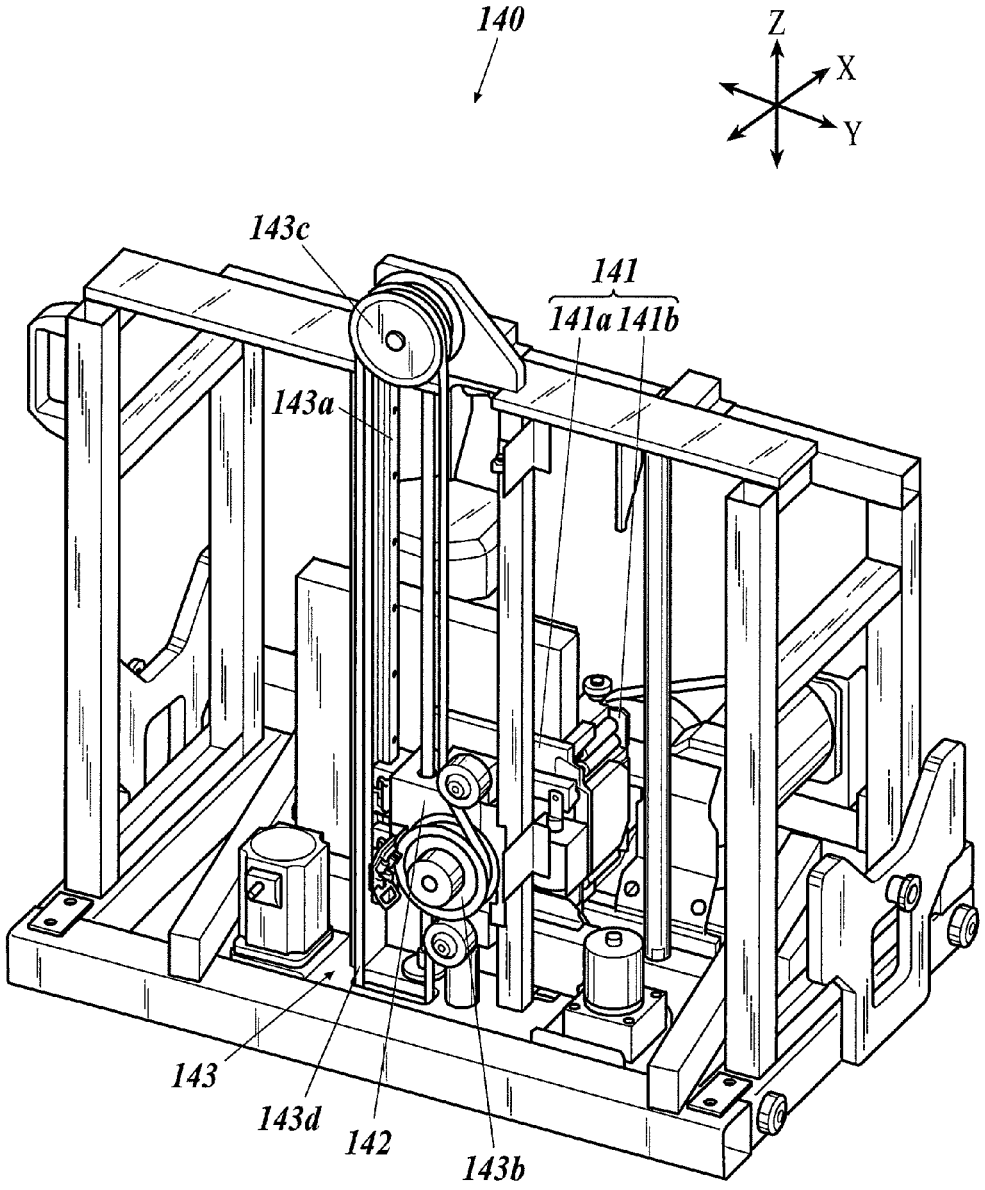


FIG.9

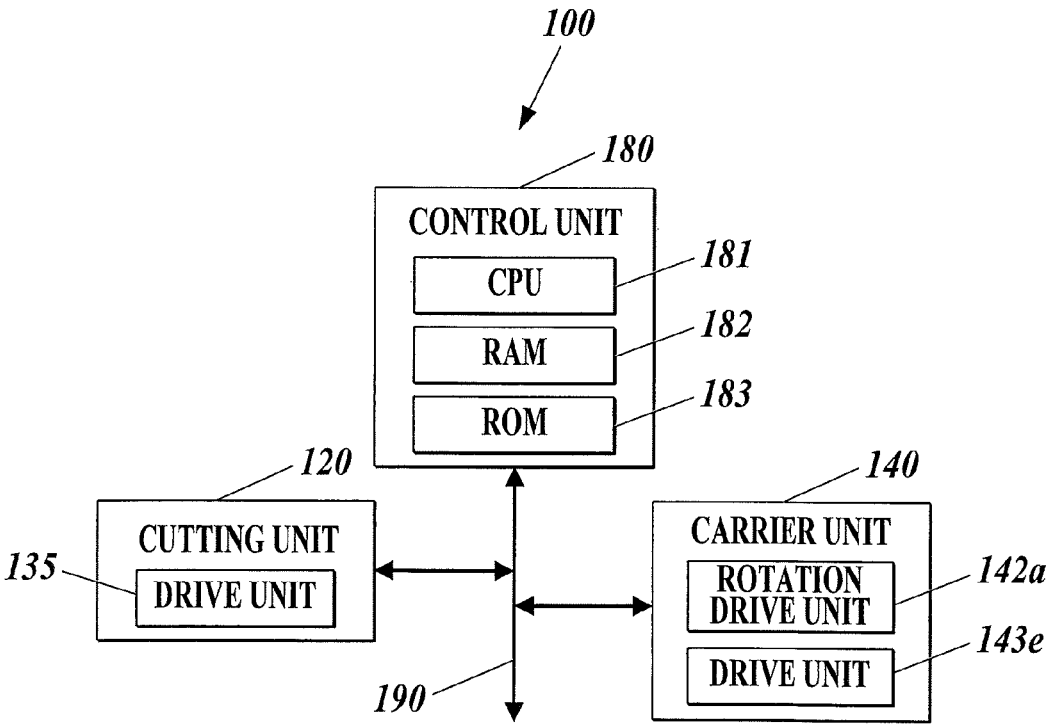
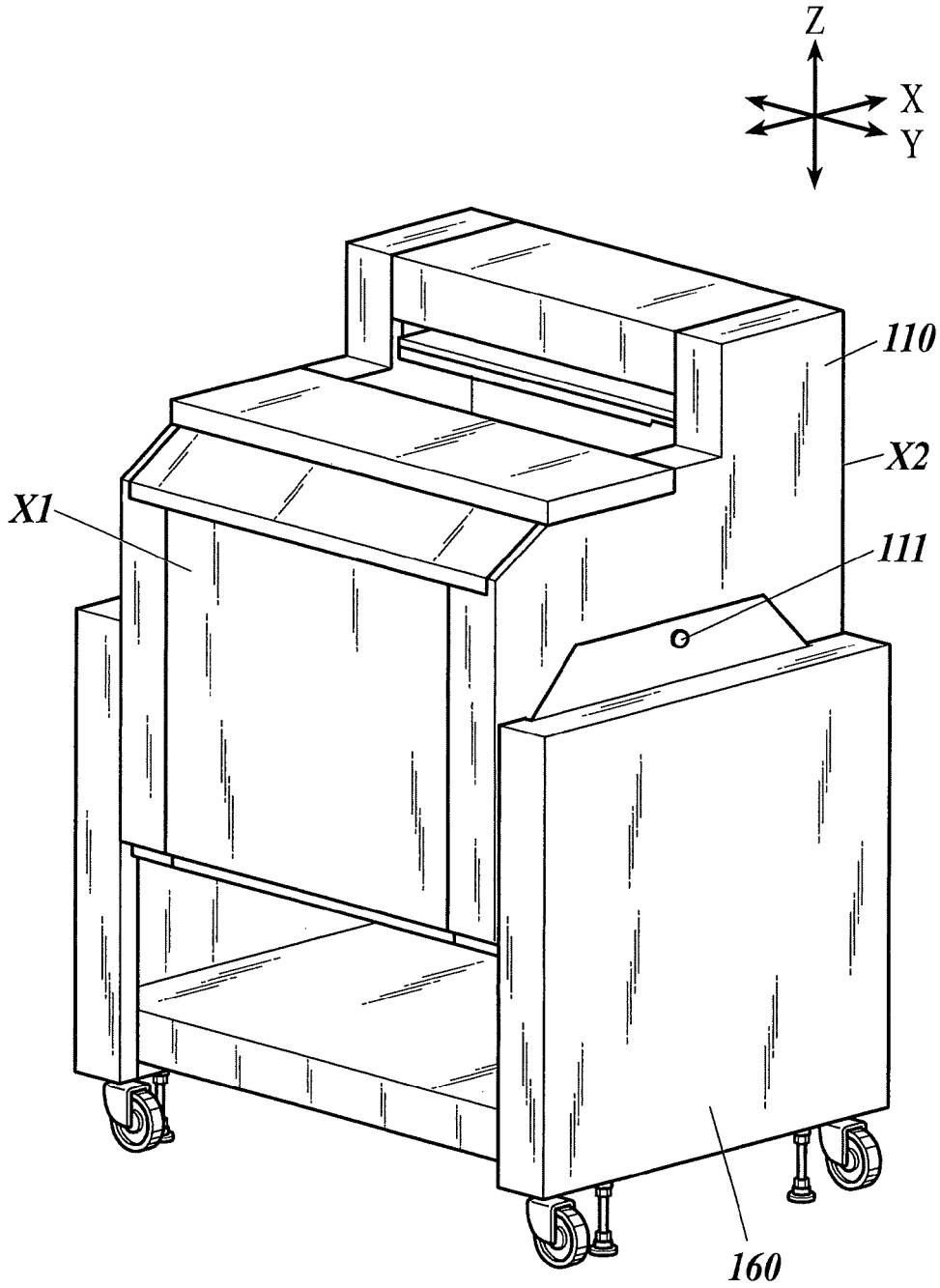

100
180
CONTROL UNIT
CPU
RAM
ROM
181
182
183
120
CUTTING UNIT
DRIVE UNIT
135
140
CARRIER UNIT
ROTATION DRIVE UNIT
DRIVE UNIT
142a
143e
190

FIG.10



CUTTING DEVICE AND IMAGE FORMING SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

The present invention claims priority under 35 U.S.C. §119 to Japanese Application No. 2012-096263 filed Apr. 20, 2012, the entire content of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a cutting device and an image forming system.

2. Description of the Related Art

In order to create a booklet by superposing sheets of paper on which images are formed by an image forming device, cutting processing to cut off some edge portions of the booklet is performed in general. By the cutting processing, margins of sheets which constitute a booklet can be aligned.

As a cutting device to perform the above-described cutting processing, as disclosed in Japanese Patent Application Laid-Open Publication No. 2008-30131 or Japanese Patent Application Laid-Open Publication No. 2008-30143, there is known a cutting device which cuts off edge portions of a booklet with a blade disposed at a lower part of a case. The cutting device makes the blade, which is disposed along a horizontal direction, abut a booklet, which is held along a vertical direction, so as to cut off an edge portion of the booklet.

By the way, it is unavoidable that a blade is degraded because the blade is repeatedly used. Hence, the blade is regularly replaced with another blade.

However, in a conventional cutting device, a blade is disposed at a lower part of a case, namely, on the lower side of the cutting device. Hence, it is difficult to replace the blade with another blade from the upper side or the lateral sides of the cutting device. More specifically, in order for a maintenance person to safely replace a blade with another blade, the maintenance person needs to see the blade before replacing the blade with another blade. However, to see a blade of a conventional cutting device, a maintenance person needs to get under the cutting device, the bottom of which is lifted. Hence, work efficiency is low.

BRIEF SUMMARY OF THE INVENTION

The present invention is made in view of the circumstances, and objects of the present invention include providing a cutting device and an image forming system each of which makes it easy to replace a blade with another blade.

In order to achieve at least one of the objects, according to an aspect of the present invention, there is provided a cutting device including: a main body unit including a cutting unit on a lower side, the cutting unit which cuts off an edge portion of paper; a support unit which supports the main body unit in such a way that the main body unit rotates, wherein the main body unit exposes a blade of the cutting unit at least on a lateral side by rotating.

Preferably, in the cutting device, the main body unit makes the edge portion, which is cut off by the cutting unit, come out of the main body unit downward so as to cut off the edge portion downward.

Preferably, in the cutting device, the blade faces upward in response to the main body unit rotating to expose the cutting unit on the lateral side.

Preferably, in the cutting device, the blade includes two blades which face each other, in response to the main body unit being at a first rotation angle, one of the blades faces upward, and in response to the main body unit being at a second rotation angle, the other of the blades faces upward.

Preferably, in the cutting device, the first rotation angle and the second rotation angle are rotation angles to which the main body unit rotates about 90 degrees from a reference rotation angle of the main body unit in different directions, the reference rotation angle at which the cutting unit is disposed on the lower side.

Preferably, in the cutting device, the support unit supports the main body unit via a rotation shaft which passes through the center of gravity or near the center of gravity of the main body unit in such a way that the main body unit rotates.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The present invention is fully understood from the detailed description given hereinafter and the accompanying drawings, which are given byway of illustration only, and thus are not intended to limit the present invention, wherein:

FIG. **1** shows main components of an image forming system in accordance with an embodiment of the present invention;

FIG. **2** is a perspective view of a cutting device;

FIG. **3** is a perspective view of the cutting device at a first rotation angle at which a main body unit exposes blades of a cutting unit on a lateral side;

FIG. **4** is a perspective view of the cutting device at a second rotation angle at which the main body unit exposes the blades of the cutting unit on a lateral side;

FIG. **5** is a perspective view of a carrier unit in the main body unit at a cutting rotation angle;

FIG. **6** is a perspective view of the carrier unit which rotates a booklet and moves the booklet downward from the state shown in FIG. **5**;

FIG. **7** is a perspective view of the carrier unit in fore-edge cutting processing;

FIG. **8** is a perspective view of the carrier unit in top-edge/tail-edge cutting processing;

FIG. **9** is a block diagram of main components related to control of operations of the cutting device; and

FIG. **10** is a perspective view of the cutting device provided with a rotation shaft near the center of gravity of the main body unit.

DETAILED DESCRIPTION OF THE INVENTION

In the following, an embodiment of the present invention is described with reference to the drawings. The embodiment includes various technically-preferred limitations to realize the present invention. However, the scope of the present invention is not limited to the embodiment or the drawings.

FIG. **1** shows main components of an image forming system **1** in accordance with an embodiment of the present invention.

The image forming system **1** includes an image forming device **10**, a paper processing device **20**, a carrier device **30** and a cutting device **100**.

The image forming device **10** forms images on sheets of paper.

More specifically, the image forming device **10** includes a carrier unit, a developer unit, a primary transfer unit, a secondary transfer unit, a fixation unit and an ejection unit so as to form images on sheets of paper. The carrier unit takes out sheets of paper stored in a paper tray as a recording medium and carries the paper. The developer unit develops toner images corresponding to bitmap data on a primary transfer member such as a transfer roller. The primary transfer unit transfers the toner images developed on the primary transfer member to a secondary transfer member such as a transfer drum. The secondary transfer unit transfers the toner images transferred to the secondary transfer member to the paper carried by the carrier unit. The fixation unit fixes the toner images, which are transferred to the paper, on the paper. The ejection unit ejects the paper on which the toner images are fixed by the fixation unit.

The image forming device **10** delivers the paper on which the images are formed and ejected therefrom to the paper processing device **20**.

The paper processing device **20** creates a booklet from the sheets of the paper on which the images are formed by the image forming device **10**.

More specifically, the paper processing device **20** includes a stapling unit, a gluing unit and an ejection unit, for example. The stapling unit staples the sheets of the paper delivered from the image forming device **10** so as to make a booklet. The gluing unit glues the spine side of the booklet, on which the stapling is performed, so as to put a cover. The paper processing device **20** can eject the sheets of the paper delivered from the image forming device **10** without performing the stapling.

The above-described method for creating a booklet by the paper processing device **20** is an example, and hence not limited thereto. For example, the paper processing device **20** may omit the stapling, and instead glue a spine side of a bundle of sheets and wrap the bundle in a cover so as to create a booklet.

The carrier device **30** carries booklets or sheets (a booklet or booklets, hereinafter) ejected from the paper processing device **20** to the cutting device **100**.

More specifically, for example, as shown in FIG. **1**, the carrier device **30** includes a belt conveyer mechanism unit **31**, a delivery unit **32** and a standby unit **33**, and places booklets on a belt so as to carry the booklets from the carrier device **30** to the cutting device **100**. The belt conveyer mechanism unit **31** carries booklets in a predetermined direction. The delivery unit **32** displaces each booklet in such a way that the paper surfaces thereof are along a vertical direction, the booklet which is carried by the belt conveyer mechanism unit **31** with the paper surfaces thereof along a horizontal direction, and delivers the booklet to the cutting device **100**. The standby unit **33** puts booklets on standby until the delivery unit **32** delivers the booklets to the cutting device **100**.

The cutting device **100** performs cutting processing to cut edge portions of booklets and various types of processing related to the cutting processing.

The image forming system **1** of the embodiment is an image forming system to (i) form images on sheets of paper, (ii) bundle the sheets, on which images are formed, so as to create a booklet, and (iii) cut off edge portions of the booklet with the cutting device **100**.

FIG. **2** is a perspective view of the cutting device **100**.

The cutting device **100** includes a main body unit **110** and a support unit **160**. The main body unit **110** includes a cutting unit **120** and a carrier unit **140**. The cutting unit **120** cuts off edge portions of a booklet. The carrier unit **140** keeps the booklet carried from the carrier device **30**, and carries the booklet to the cutting unit **120**. The support unit **160** supports the main body unit **110** in such a way that the main body unit **110** rotates.

The main body unit **110** is configured to expose blades **121** and **122** of the cutting unit **120** disposed on a lower side (i.e. at a lower part of the main body unit) at least on a lateral side.

In the following, when change of rotation angles of the main body unit **110** is explained, an angle of the main body unit **110** of the cutting device **100** shown in FIG. **2** is regarded as a reference rotation angle. The reference rotation angle of the main body unit **110** shown in FIG. **2** is a rotation angle (cutting rotation angle) at which an edge portion of a booklet is cut off downward by the cutting unit **120**. The edge portion to be cut off by the cutting unit **120** is made to come out of the main body unit **110** downward.

As shown in FIGS. **1** and **2**, the vertical direction is a Z direction, and, of the horizontal direction, a direction along a direction in which booklets are carried by the belt conveyer mechanism unit **31** of the carrier device **30** to the cutting device **100** is an X direction, and a direction being at right angles to the Z direction and the X direction is a Y direction. In the X direction, a side to which booklets are carried to the cutting device **100** is the front side, and its opposite side is the back side. The right side and the left side are determined in the Y direction for convenience. Their correspondence relationship is shown in FIGS. **2** to **4**.

A lateral surface of the main body unit **110** on the front side and a lateral surface thereof on the back side when the main body unit **110** is at the cutting rotation angle shown in FIG. **2** are a lateral surface X**1** and a lateral surface X**2**, respectively.

As shown in FIG. **2**, the support unit **160** supports the main body unit **110** in such a way that the main body unit **110** rotates via a rotation shaft **111** disposed on lateral surfaces of the main body unit **110**, the lateral surfaces being at right angles to the lateral surfaces X**1** and X**2** and a bottom **112**. That is, a rotational center axis of the main body unit **110** is along the Y direction.

FIGS. **3** and **4** are perspective views each showing the cutting device **100** at a rotation angle at which the main body unit **110** exposes the blades **121** and **122** of the cutting unit **120** on a lateral side. FIG. **3** is a perspective view of the cutting device **100** viewed from the front side while FIG. **4** is a perspective view thereof viewed from the back side.

As shown in FIG. **3**, the main body unit **110** rotates in such a way that the lateral surface X**1** is positioned on the upper side. The main body unit **110** is in a state in which the blades **121** and **122** of the cutting unit **120** are exposed on a lateral side (front side) at a first rotation angle at which the lateral surface X**1** is positioned on the upper side.

As shown in FIG. **4**, the main body unit **110** also rotates in such a way that the lateral surface X**2** is positioned on the upper side. The main body unit **110** is in a state in which the blades **121** and **122** of the cutting unit **120** are exposed on a lateral side (back side) at a second rotation angle at which the lateral surface X**2** is positioned on the upper side.

As shown in FIGS. **3** and **4**, the bottom **112** of the main body unit **110** does not have a wall-type cover member, and accordingly is open. Consequently, the components (units and the like) inside the main body unit **110**, such as the components of the cutting unit **120**, are exposed.

As shown in FIGS. **3** and **4**, by rotating the main body unit **110** in such away that the bottom **112** is positioned on a lateral side (i.e. a lateral side of the cutting device **100**), the bottom **112** can be accessed from the lateral side of the cutting device **100**. Accordingly, a replacement operation of the blades **121** and **122** of the cutting unit **120** disposed on the lower side at the cutting rotation angle can be performed from the lateral

side of the cutting device **100**, the lateral side on which the bottom **112** is positioned by the rotation of the main body unit **110**.

Here, the cutting unit **120** is described.

The cutting unit **120** includes two blades, namely, the blades **121** and **122**, which face each other.

Each of the blades **121** and **122** is a plate-shaped member, the longitudinal direction of which is along the Y direction.

More specifically, each of the blades **121** and **122** is a plate-shaped member disposed along the bottom **112** of the main body unit **110**. That is, at the cutting rotation angle shown in FIG. **2**, the blades **121** and **122** are along the horizontal direction (an X-Y plane), and at the rotation angles shown in FIGS. **3** and **4**, the blades **121** and **122** are along a Y-Z plane.

At least one (the blade **121**, for example) of the blades **121** and **122** has a cutting edge at one side of two sides of the blade in the longitudinal direction thereof. The other side of the blade **121** in the longitudinal direction is held by a holding unit **123**, and the other side of the blade **122** in the longitudinal direction is held by a holding unit **124**.

The holding units **123** and **124** respectively hold the above-described other sides of the blades **121** and **122** in such a way that the blades **121** and **122** are along the bottom **112** of the main body unit **110**. The holding units **123** and **124** respectively hold the blades **121** and **122** in such away that the blades **121** and **122** face each other too.

The holding unit **124** is fixed to a predetermine point of the main body unit **110**. Accordingly, the blade **122** held by the holding unit **124** is fixed to the predetermined point of the main body unit **110**.

The holding unit **123** moves the blade **121** close to and away from the blade **122**.

More specifically, on the bottom **112** of the main body unit **110**, two prismatic support members **125** disposed along the bottom **112** and parallel to each other are disposed. The holding unit **124** is disposed between the two support members **125**, whereby the holding unit **124** forms the shape of "H" on the bottom **112** with the two support members **125**.

As shown in FIGS. **3** and **4**, the two support members **125** are disposed to each have a predetermined inclination toward a direction being at right angles to the lateral surfaces X**1** and X**2**.

On a side (a bottom **112** side) of each of the two support members **125**, the side close to (i.e. facing) the bottom **112**, a guide rail **126** is disposed. The guide rails **126** are disposed along an extending direction in which the two support members **125** run, and engage with the plate-shaped holding unit **123**, which is along the bottom **112**, so as to guide movement of the holding unit **123**. That is, the holding unit **123** moves along the extending direction of the two support members **125** provided with the guide rails **126**.

The holding unit **123** is connected to a blade movement mechanism unit including eccentric cams **131** and **132**, connecting members **133** and **134** and a drive unit **135**. The connecting members **133** and **134** respectively connect the eccentric cams **131** and **132** to the holding unit **123**. The drive unit **135** rotates the eccentric cams **131** and **132**. The holding unit **123** moves along the guide rails **126** in response to an operation of the blade movement mechanism unit. Consequently, the blade **121** held by the holding unit **123** moves close to or away from the blade **122** held by the holding unit **124**. At the time when the blade **121** is close to the blade **122**, the blades **121** and **122** slide, so that an edge portion of a booklet sandwiched between the blades **121** and **122** is cut off.

In each of FIGS. **3** and **4**, the bottom **112** of the main body unit **110** is positioned on a lateral side (the front side or the back side). Accordingly, the blades **121** and **122** face the lateral side. However, at the cutting rotation angle shown in FIG. **2**, the bottom **112** is positioned on the lower side and along the horizontal direction. Accordingly, the blades **121** and **122** are along the horizontal direction, and a moving direction of the blade **121** is the horizontal direction too. That is, when the main body unit **110** is at the cutting rotation angle shown in FIG. **2**, the cutting unit **120** makes an edge portion of a booklet come out of the main body unit **110** downward through the blades **121** and **122** so as to cut off the edge portion downward.

As shown in FIG. **2**, there is a space between the bottom **112** of the main body unit **110** at the cutting rotation angle and the support unit **160**. At the cutting rotation angle, edge portions of booklets cut off by the cutting unit **120** drop through the space and are piled on the support unit **160**. That is, the support unit **160** has a function to accumulate edge portions of booklets, the edge portions which are cut off to be discarded.

The space between the bottom **112** of the main body unit **110** and the support unit **160** also has a function to prevent the lower ends of the lateral surfaces X**1** and X**2** of the main body unit **110** from hitting the support unit **160** when the main body unit **110** rotates from the cutting rotation angle as shown in FIGS. **3** and **4**.

Replacement of the blades **121** and **122** of the cutting unit **120** with other blades is performed when the cutting device **100** is not in operation. That is, the rotation angles of the main body unit **110** shown in FIGS. **3** and **4**, the rotation angles at which the replacement of the blades **121** and **122** can be performed, are rotation angles (no-cutting rotation angle) at which the cutting device **100** is not in operation.

In other words, the main body unit **110** can change the cutting rotation angle and the no-cutting rotation angle, at which the blades **121** and **122** are exposed on a lateral side.

The first rotation angle shown in FIG. **3** and the second rotation angle shown in FIG. **4** are angles to which the main body unit **110** rotates about 90 degrees from the cutting rotation angle shown in FIG. **2** in different directions.

Thus, the cutting device **100** is configured in such a way that the blade **121** faces upward when the main body unit **110** is at the first rotation angle, and the blade **122** faces upward when the main body unit **110** is at the second rotation angle.

Although not being shown, the cutting device **100** is configured in such a way that the upper part of the main body unit **110** at the cutting rotation angle does not go down lower than a position of the upper part thereof at the first rotation angle or the second rotation angle. More specifically, for example, one or both of the lateral surfaces where the rotation shaft **111** is disposed is provided with a projecting unit which projects from the lateral surface to the outside, and when the main body unit **110** rotates and reaches the first rotation angle or the second rotation angle, the projecting unit abuts the support unit **160** so as to stop the main body unit **110**. Keeping a rotation angle of the main body unit **110** by the projecting unit is an example, and hence the first rotation angle and the second rotation angle may be kept by another method.

In the case of the first rotation angle shown in FIG. **3**, the blade **121** is positioned above the blade **122** and the cutting edge of the blade **121** faces downward while the blade **122** is positioned under the blade **121** and the cutting edge of the blade **122** faces upward.

In the case of the second rotation angle shown in FIG. **4**, the blade **121** is positioned under the blade **122** and the cutting edge of the blade **121** faces upward while the blade **122** is positioned above the blade **121** and the cutting edge of the

blade **122** faces downward. By replacing the blade **121** with another blade, namely, an unused blade, when, as shown in FIG. **4**, the main body unit **110** is at the second rotation angle at which the cutting blade **121** is positioned under the blade **122**, the blades **121** and **122** can be replaced with other blades safely.

Furthermore, the rotation angles of the main body unit **110** can be properly used depending on a blade (**121** or **122**) to be replaced with another blade. Accordingly, the blades **121** and **122** can be replaced with other blades more safely.

Next, the carrier unit **140** is described with reference to FIGS. **5** to **8**.

FIGS. **5** to **8** are perspective views each showing the carrier unit **140** in the main body unit **110** at the cutting rotation angle.

The carrier unit **140** includes a sandwiching unit **141**, a rotation unit **142** and a linear movement unit **143**. The sandwiching unit **141** holds a booklet delivered from the delivery unit **32** of the carrier device **30**. The rotation unit **142** supports the sandwiching unit **141** in such a way that the sandwiching unit **141** rotates. The linear movement unit **143** supports the rotation unit **142** in such a way that the rotation unit **142** linearly moves.

The sandwiching unit **141** includes two sandwiching members **141***a* and **141***b* each of which has a surface part which abuts a paper surface of a booklet. The sandwiching unit **141** is configured in such a way that a distance between the surface parts of the sandwiching members **141***a* and **141***b* changes. The two sandwiching members **141***a* and **141***b* move close to or away from each other so as to have a distance between the surface parts, the distance corresponding to the thickness of a booklet, thereby sandwiching the booklet. The surface parts of the two sandwiching members **141***a* and **141***b* are along the lateral surfaces X**1** and X**2** of the main body unit **110**. That is, the sandwiching unit **141** holds a booklet in such a way that the paper surfaces of the booklet are along the lateral surfaces X**1** and X**2**.

The rotation unit **142** supports the sandwiching member **141***a* of the sandwiching unit **141** in such a way that the sandwiching member **141***a* rotates. The rotation unit **142** includes a rotation drive unit **142***a* (shown in FIG. **9**) which operates under the control of a control unit **180** (shown in FIG. **9**) of the cutting device **100**. The rotation unit **142** rotates the sandwiching unit **141** by drive of the rotation drive unit **142***a* and holds the sandwiching unit **141** at a predetermined rotation angle so as to control a rotation angle of a booklet held by the sandwiching unit **141**.

The rotation unit **142** engages with a guide rail **143***a* disposed, in the main body unit **110**, along a direction which is at right angles to a surface direction of the bottom **112** so as to linearly move along the guide rail **143***a*.

The linear movement unit **143** includes the guide rail **143***a*, a pulley **143***b*, a pulley **143***c*, a belt **143***d* and a drive unit **143***e* (shown in FIG. **9**). The pulley **143***b* rotates on a rotation shaft thereof fixed to the rotation unit **142**. The pulley **143***c* is disposed on a side opposite to a delivery opening **145** for booklets with respect to an extending direction of the guide rail **143***a*. The belt **143***d* connects the pulley **143***b*, the pulley **143***c* and the like to each other. The drive unit **143***e* linearly moves the rotation unit **142** along the guide rail **143***a* by drive of the belt **143***d*. The linear movement unit **143** linearly moves the rotation unit **142** so as to linearly move a booklet held by the sandwiching unit **141** to the delivery opening **145**.

As shown in FIGS. **5** to **8**, the delivery opening **145** is provided on the bottom **112** side. The delivery opening **145** is provided between the blade **121** and the blade **122** of the cutting unit **120**. The components of the carrier unit **140** carry a booklet delivered from the delivery unit **32** of the carrier device **30** into the delivery opening **145**, and keeps the booklet there, thereby keeping the booklet between the blade **121** and the blade **122**. At the time, an edge portion of the booklet to be cut off by the cutting unit **120** is out of the main body unit **110** from the bottom **112** downward. In this state, the cutting unit **120** operates, and the blade **121** moves close to the blade **122**, so that the edge portion of the booklet is cut off and drops down.

The carrier unit **140** linearly moves the booklet, edge portions of which have been cut off (cutting processing), in such a way that the booklet is away from the delivery opening **145**. Then, as shown in FIG. **2**, the carrier unit **140** sends out the booklet, on which the cutting processing has been performed, by using a not-shown sending-out mechanism unit.

The cutting processing performed by the cutting unit **120** includes fore-edge cutting processing and top-edge/tail-edge cutting processing. The fore-edge cutting processing is cutting processing to cut off, among the edge portions of a booklet, an edge portion of the booklet (margins of pages constituting a booklet), the edge portion being parallel to the spine of the booklet. The top-edge/tail-edge cutting processing is cutting processing to cut off, among the edge portions of a booklet, edge portions of the booklet (margins of pages constituting a booklet), the edge portions being at right angles to the spine of the booklet. There are two edge portions which are at right angles to the spine. Hence, the top-edge/tail-edge cutting processing is performed twice by rotating a booklet.

In the following, operations of the carrier unit **140** performed as the cutting processing is performed are described.

First, as shown in FIG. **5**, the carrier unit **140** holds with the sandwiching unit **141***a* booklet delivered from the delivery unit **32** of the carrier device **30**. At the time, the spine of the booklet faces the delivery opening **145**.

Next, the carrier unit **140** linearly moves the rotation unit **142** to the delivery opening **145** while rotating the sandwiching unit **141**. Consequently, as shown in FIG. **6**, the booklet is carried to the delivery opening **145** while changing its orientation.

In the case of the fore-edge cutting processing, as shown in FIG. **7**, the carrier unit **140** carries a booklet into the delivery opening **145** in such a way that an edge portion of the booklet, the edge portion being parallel to the spine, faces the bottom **112**.

In the case of the top-edge/tail-edge cutting processing, as shown in FIG. **8**, the carrier unit **140** carries a booklet into the delivery opening **145** in such a way that an edge portion of the booklet, the edge portion being at right angles to the spine, faces the bottom **112**.

In the embodiment, the fore-edge cutting processing and the top-edge/tail-edge cutting processing are performed to cut off edge portions of a booklet in the order named. However, this is not a limitation but an example.

In the case of a no-booklet, such as a sheet of paper, an edge portion (margin) of the sheet, the edge portion being parallel to an edge portion (margin) thereof positioned between the two sandwiching members **141***a* and **141***b* of the sandwiching unit **141**, is cut off by the fore-edge cutting processing, and two edge portions (margins) of the sheet, the edge portions being at right angles to the edge portion thereof positioned between the two sandwiching members **141***a* and **141***b* thereof, are cut off by the top-edge/tail-edge cutting processing.

FIG. **9** is a block diagram of main components related to control of operations of the cutting device **100**.

As shown in FIG. **9**, the cutting device **100** includes the control unit **180** which controls operations of the components

(units and the like) of the cutting device **100**. The control unit **180** includes a CPU **181**, a RAM **182** and a ROM **183**. The CPU **181** reads programs and/or data in accordance with processing contents from a storage device, such as the ROM **183**, so as to perform processing in accordance with the read programs and/or data, and controls operations of the components, such as the drive unit **135**, the rotation drive unit **142***a* and the drive unit **143***e*, which are connected to each other and to the control unit **180** via a bus **190**.

As described above, according to the image forming system **1** of the embodiment, the main body unit **110** of the cutting device **100** rotates to expose the blades **121** and **122** of the cutting unit **120** on a lateral side. Accordingly, a replacement operation of the blades **121** and **122** of the cutting unit **120** disposed on the lateral side by the rotation of the main body unit **110** can be performed from the lateral side of the cutting device **100**. Accordingly, the blades **121** and **122** can be more easily replaced with other blades.

Furthermore, the main body unit **110** can change the cutting rotation angle, at which an edge portion of a booklet to be cut off by the cutting unit **120** comes out of the main body unit **110** downward so as to cut off the edge portion downward, and the no-cutting rotation angle, at which the blades **121** and **122** of the cutting unit **120** are exposed on a lateral side. Consequently, the blades **121** and **122** of the cutting device **100**, which can easily separate an edge portion to be cut off from a booklet by dropping the edge portion when the cutting processing is performed on the booklet, can be easily replaced with other blades at the time when the cutting processing is not performed.

Furthermore, the cutting unit **120** has the two blades **121** and **122**, the cutting edges of which face each other, and the main body unit **110** can change the first rotation angle, at which the cutting edge of the blade **121** faces upward, and the second rotation angle, at which the cutting edge of the blade **122** faces upward, as the no-cutting rotation angle. Accordingly, by placing the main body unit **110** at a rotation angle at which the cutting edge of one of the blades **121** and **122**, the one to be replaced with another blade, faces upward, the blades **121** and **122** can be replaced with other blades more safely.

Furthermore, the first rotation angle and the second rotation angle are rotation angles to which the main body unit **110** rotates about 90 degrees from the cutting rotation angle in different directions. Accordingly, only by changing the directions to rotate the main body unit **110**, a blade, the cutting edge of which faces upward, can be changed between the blades **121** and **122**.

The embodiment described herein is to be considered in all respects illustrative and not limitative. The scope of the present invention is to be indicated by the appended claims, rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein.

For example, in the embodiment, the rotation shaft **111** of the main body unit **110** is disposed near the bottom **112**. However, this is not a limitation but an example. As shown in FIG. **10**, the rotation shaft **111** may be disposed at a higher position than the position thereof shown in FIG. **2**. The support unit **160** supports the main body unit **110** in such a way that the main body unit **110** rotates via the rotation shaft **111** which passes through the center of gravity of the main body unit **110** or near the center of gravity thereof. Accordingly, the main body unit **110** can be supported more stably. In addition, because a weight balance of the cutting device **100** does not change depending on the change of rotation angles even when the main body unit **110** rotates, the rotation angles can be changed more stably.

Furthermore, in the embodiment, there are two rotation angles as the no-cutting rotation angle, namely, the first rotation angle and the second rotation angle. However, this is not a limitation but an example. As long as there is at least one rotation angle at which the blade **121** (and the blade **122**) of the cutting unit **120** is exposed on a lateral side so that the blade **121** can be easily seen when the blade **121** is replaced with another blade, the number of rotation angles as the no-cutting rotation angle is not limited. For example, the main body unit **110** may be configured to rotate 180 degrees or 360 degrees from the cutting rotation angle so that the cutting unit **120** is exposed on the upper side.

Furthermore, it is unnecessary for the no-cutting rotation angle to be different about 90 degrees from the cutting rotation angle as long as the no-cutting rotation angle is a rotation angle at which the blades **121** and **122** can be safely replaced with other blades. Furthermore, not being limited to the first rotation angle and the second rotation angle, a multiple number of steps for rotation angles in one rotational direction of the main body unit **110** may be provided so as to change the rotation angles. Accordingly, the best rotation angle for a maintenance person to perform the replacement operation can be used in accordance with various conditions, such as the height of the maintenance person. Alternatively, there may be no step for rotation angles. In this case, it is preferable to provide a stopper unit to hold the main body unit **110** at a desired rotation angle (a clutch mechanism unit to keep a rotation angle of the main body unit **110**, for example).

Furthermore, in the embodiment, the two blades **121** and **122** are provided. However, this is not a limitation but an example. As long as sheets of paper can be cut by at least one blade, there is no limitation. Here, the blade can be safely replaced with another blade by making the cutting edge of the blade face upward when the cutting unit **120** is exposed on a lateral side by the rotation of the main body unit **110**.

Furthermore, it is unnecessary that the cutting edge of a blade to be replaced with another blade faces upward as long as safety of a maintenance person who replaces the blade can be ensured. For example, the blade may be covered with a cover member, and replaced with another blade.

Furthermore, in the embodiment, the main body unit **110** is expected to be manually rotated with respect to the support unit **160**. However, this is not a limitation but an example. The main body unit **110** may be rotated by power of a motor or the like. Alternatively, even in the case where the main body unit **110** is manually rotated, a mechanical component to change rotation angles, such as a lever, may be provided.

The components (units and the like) of the image forming system **1** described in the embodiment are not limitations but examples. Hence, for example, the cutting device **100** may have some or all of the components (configuration) of the carrier device **30**.

This application is based upon and claims the benefit of priority under 35 USC 119 of Japanese Patent Application No. 2012-096263 filed on Apr. 20, 2012, the entire disclosure of which, including the description, claims, drawings and abstract, is incorporated herein by reference in its entirety.

What is claimed is:

1. A cutting device comprising:

a main body unit including a cutting unit on a lower side, the cutting unit which cuts off an edge portion of paper;

a support unit which supports the main body unit in such a way that the main body unit rotates, wherein

the main body unit exposes a blade of the cutting unit at least on a lateral side by rotating and the main body unit makes the edge portion, which is cut off by the cutting unit, come out of the main body unit in a downward direction so that the cut off edge portion is a downward facing edge portion.

2. The cutting device according to claim **1**, wherein the blade faces upward in response to the main body unit rotating to expose the cutting unit on the lateral side.

3. The cutting device according to claim **2**, wherein

the blade includes two blades which face each other,

in response to the main body unit being at a first rotation angle, one of the blades faces upward, and

in response to the main body unit being at a second rotation angle, the other of the blades faces upward.

4. The cutting device according to claim **3**, wherein the first rotation angle and the second rotation angle are rotation angles to which the main body unit rotates about 90 degrees from a reference rotation angle of the main body unit in different directions, the reference rotation angle at which the cutting unit is disposed on the lower side.

5. The cutting device according to claim **1**, wherein the support unit supports the main body unit via a rotation shaft which passes through the center of gravity or near the center of gravity of the main body unit in such a way that the main body unit rotates.

6. An image forming system comprising:

an image forming device which performs image formation on paper; and

a cutting device comprising:

a main body unit including a cutting unit on a lower side, the cutting unit which cuts off an edge portion of paper;

a support unit which supports the main body unit in such a way that the main body unit rotates, wherein

the main body unit exposes a blade of the cutting unit at least on a lateral side by rotating and the main body unit make the edge portion, which is cut off by the cutting unit, come out of the main body unit in a downward direction so that the cut off edge portion is a downward facing edge portion,

wherein the cutting device cuts off the edge portion of the paper on which the image formation is performed by the image forming device.

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